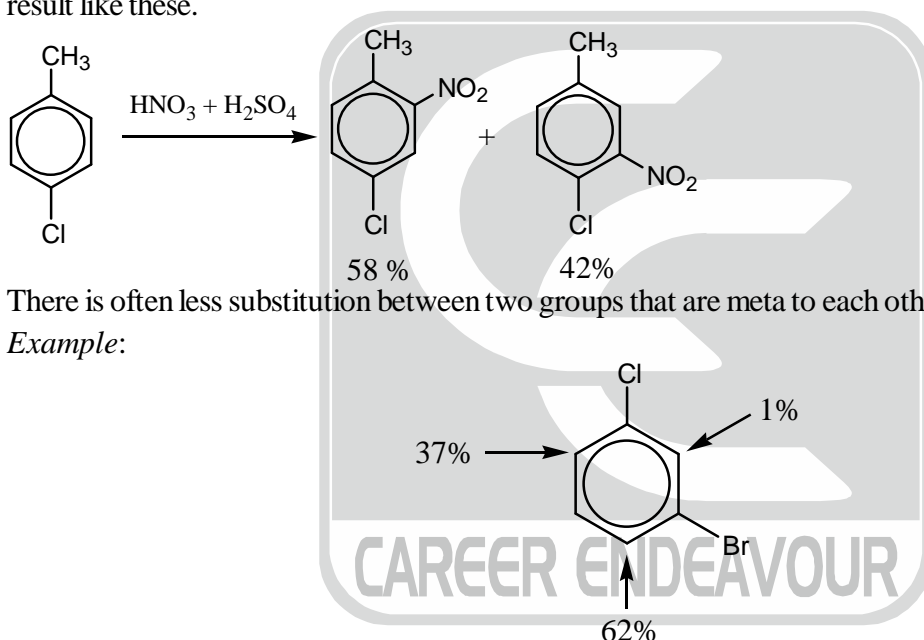
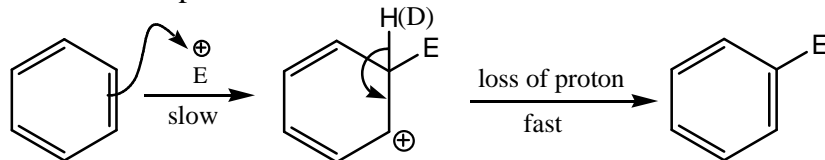
**Remark:**

There must be a large difference in the effects of the two groups for appropriate result, otherwise one gets result like these.

**Reactions on benzene ring:**

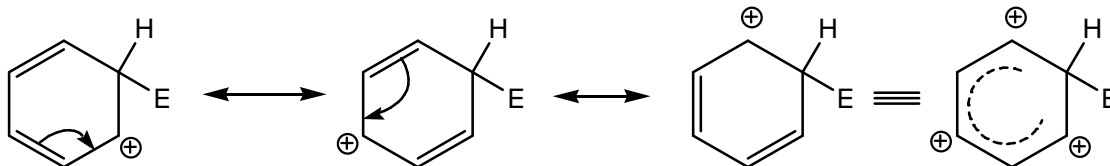
General mechanism for electrophilic aromatic substitution.



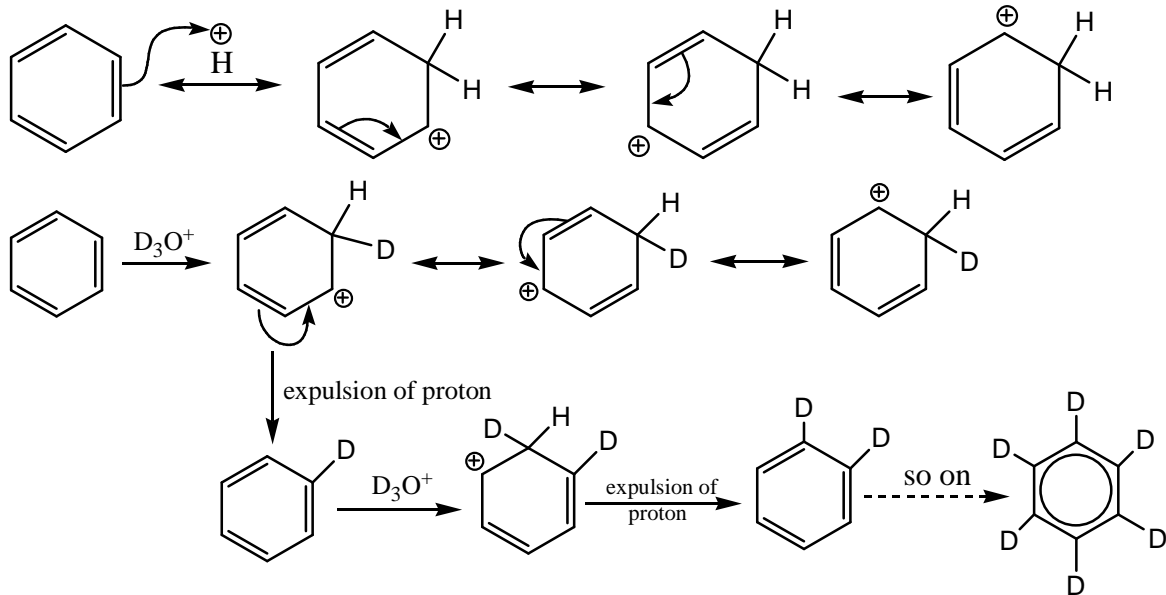
Intermediate cation
(Arenium ion or σ -complex)

Important points:

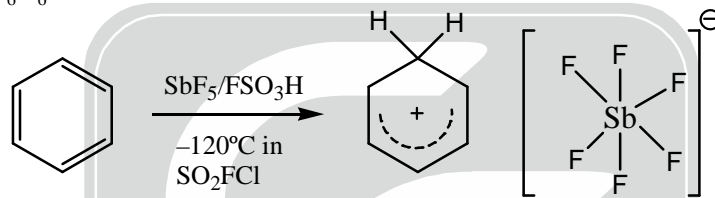
- The cation intermediate is less stable than the starting material or the product.
- The cation is reasonably stable because of delocalization around the six-membered ring.



- In strong acid, the electrophile would be a proton, the reaction would be the exchange of the proton in benzene ring. For example:

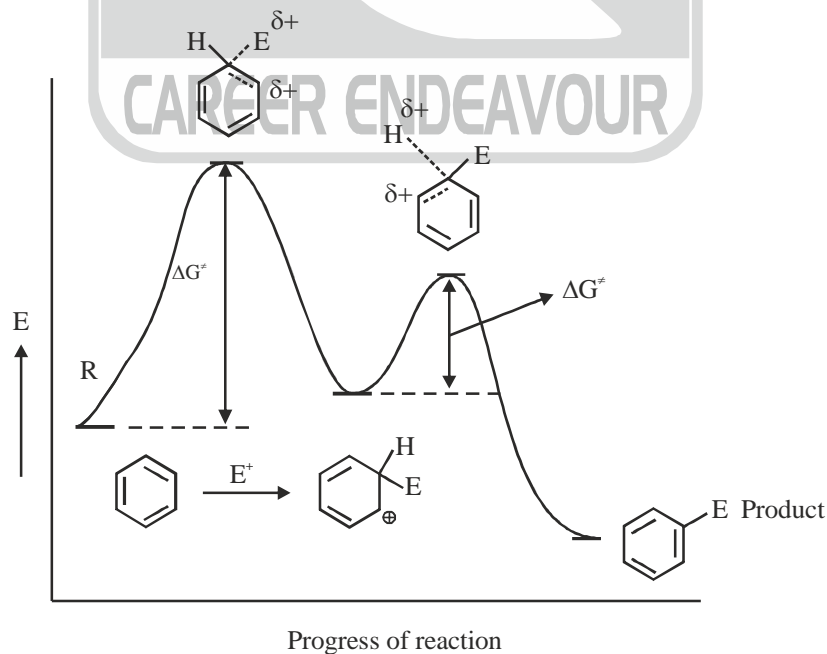


Ultimately lead to C_6D_6 which is useful solvent in NMR.



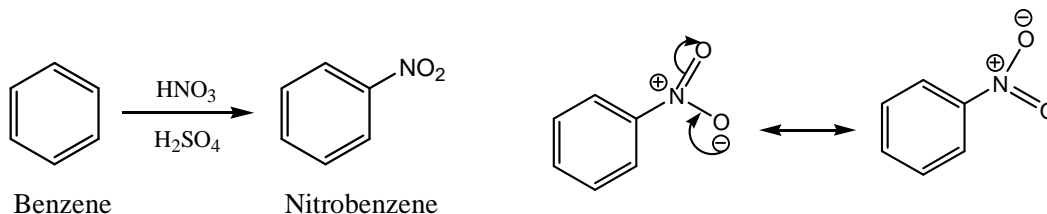
Potential energy diagram:

- Two step process.
- Since the first step involved the temporary disruption of the aromatic π system, therefore it is rate determining step.
- Second step is the fast step.



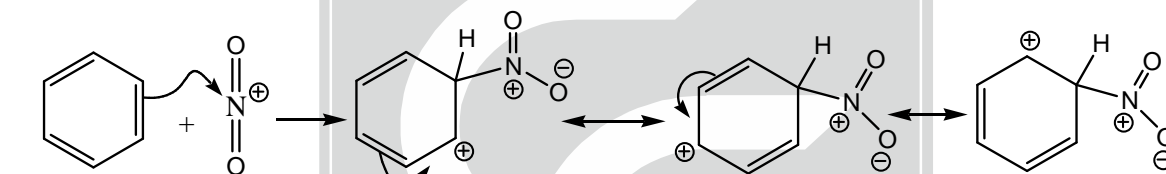
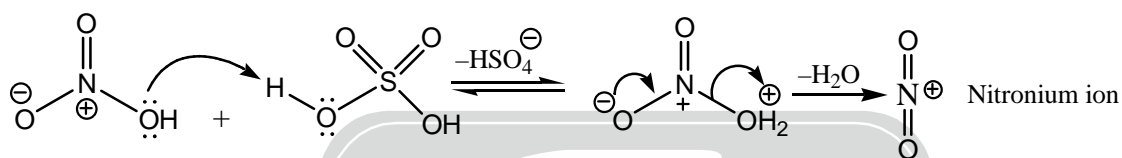
(i) **Nitration of benzene:** Important points about nitration reaction.

- Introduction of nitro group into an aromatic system.
- It provides a general entry into aromatic nitrogen compounds.
- This reaction is not available for aliphatic nitrogen compounds.
- Aromatic nitration requires very powerful reagents.
- Generally nitrating agent is mixture of concentrated nitric acid and sulphuric acid.

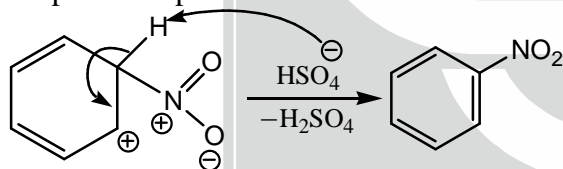


Mechanism:

Step-I: Formation of a very powerful electrophile. Sulphuric acid is the strong acid and it protonates the nitric acid.



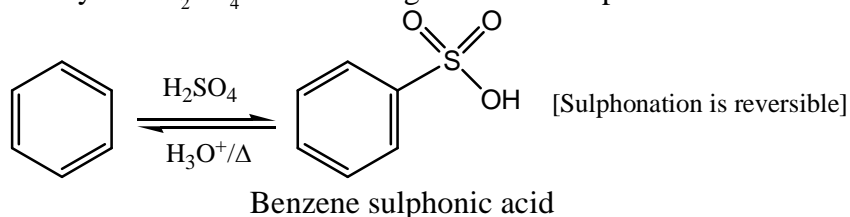
Step-II: Expulsion of proton



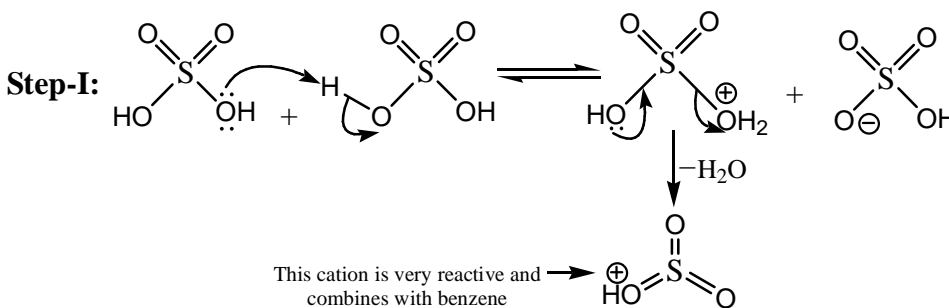
Conclusion: Nitration converts aromatic compounds into nitrobenzene using NO_2^+ from $(\text{HNO}_3 + \text{H}_2\text{SO}_4)$.

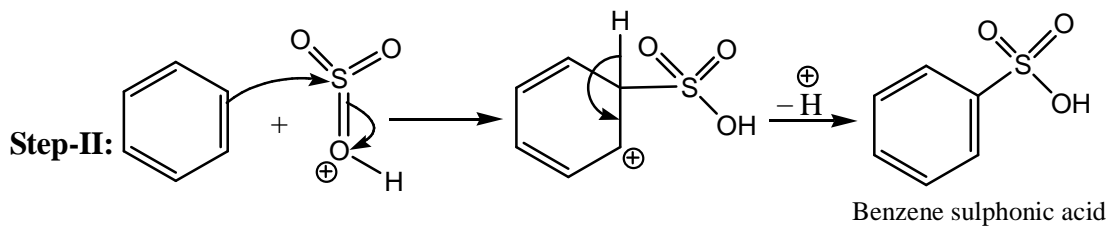
(ii) **Sulphonation of benzene:**

Benzene reacts slowly with H_2SO_4 acid alone to give benzene sulphonic acid.

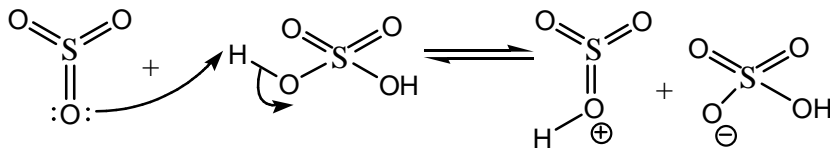


Mechanism:

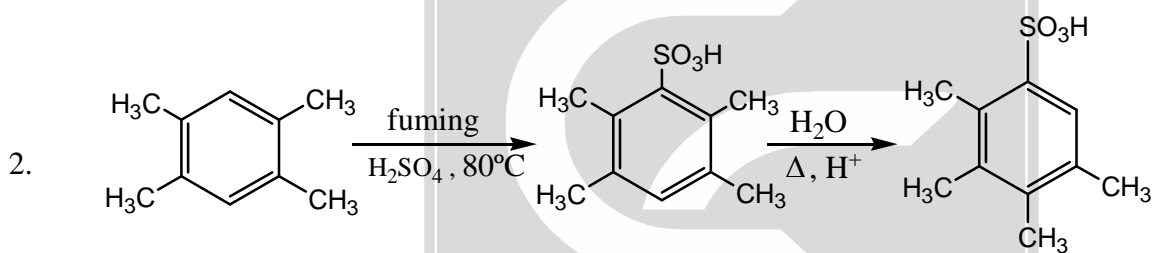
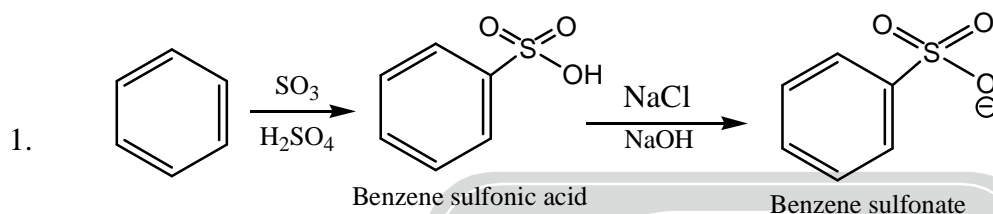




The cation intermediate can also be formed by the protonation of SO_3 .



PROBLEMS



Mechanism:

